

Title: What Will the Weather Be Today?

Brief Overview:

In this lesson, students (grades 6 - 8) will recognize the factors that interact to create weather, while comparing weather data from a locale in the USA to weather data from Antarctica. To make this comparison, students will make the necessary conversions of units to enable comparison, graph the temperatures and wind speeds for easy comparison, and analyze the data to determine windchill with the help of a windchill index chart. As a culmination of the data collection and analysis, students will make a prediction of the next days forecast using given weather descriptors that represent a range of numerical data. Students will discuss the accuracy of their predictions by comparing them to actual data from the next day.

Links to NCTM and Science Standards:

- **Mathematics as Communication**
Students will translate numerical weather data into verbal weather descriptors.
- **Mathematics as Reasoning**
Students will determine how to make conversions between Celsius and Fahrenheit, and between knots per hour, miles per hour, and kilometers per hour.
- **Computation and Estimation**
Students will compute wind speed in kilometers per hour, temperature in Celsius degrees, and estimate windchill based on temperature and wind speed data.
- **Use Appropriate Tools and Techniques to Gather, Analyze, and Interpret Data**
Students will use computers to collect, summarize, and display weather data from USA and Antarctica. Students will access, gather, store, retrieve, and organize data, using hardware and software designed for these purposes.
- **Develop Descriptions and Predictions Using Evidence**
Students will use prepared guides to describe numerical weather data in verbal terms, and make predictions of weather for the next day.
- **Think Critically and Logically to Make the Relationships Between Evidence and Explanations**
Students will think critically about evidence to decide what evidence should be used, and account for any anomalous data.

Grade/Level:

Grades 6 - 8

Duration/Length:

Four class periods (variable)

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- labeling and plotting a graph.
- reading and interpreting a chart.
- reading longitude and latitude markings around Antarctica.

Objectives:

Students will:

- translate numerical weather data into verbal weather descriptors.
- determine how to make conversions between Celsius and Fahrenheit, and between knots per hour, miles per hour, and kilometers per hour.
- compute wind speed in kilometers per hour, temperature in Celsius degrees, and estimate windchill based on temperature and wind speed data.
- use computers to collect, summarize, and display weather data from USA and Antarctica. Students will access, gather, store, retrieve, and organize data, using hardware and software designed for these purposes.
- use prepared guides to describe numerical weather data in verbal terms, and make predictions of weather for the next day.
- create a data table to record weather data from Antarctica and USA.
- think critically about evidence to decide what evidence should be used, and account for any anomalous data.

Materials/Resources/Printed Materials:

- Weather data from Antarctica (Scott Base) and USA for four days (for Antarctica this may be collected from websites such as <http://www.icair.iac.org.nz/cgi-bin/weather.pl?show=last>) or the “Sample Data” sheet R-1 may be used, and for local weather from websites such as (<http://www.wunderground.com/forecasts/BWI.html> or from local newspapers.)
- “Real Data” sheet (W-1)
- Weather Categories and Descriptors Chart (R-2)
- Beaufort Windscale (R-3) and Windchill Index Chart (R-4)
- Descriptor Table for Local and Antarctic Weather (W-2)
- Predicted Descriptors/Actual Descriptors (W-3)
- Graph paper, graphing calculators, graphing program, or spreadsheet

Development/Procedures:

- (Three days in advance) Collect weather data for your area for three consecutive days .
- Ask students to describe today’s weather for your area. What are some ways we can describe weather? What do they think the weather might be like in Antarctica? Discuss the advantages and disadvantages to using numerical and verbal descriptions.
- Collect and compile weather data from Antarctica (provided on websites, such as <http://www.icair.iac.org.nz/cgi-bin/weather.pl?show=last>) or the “Sample Data” sheet R-1 may be used) and your local area (use websites such as <http://www.wunderground.com/forecasts/BWI.html> or local newspapers). Record on “Real Data” sheet W-1.

- Create a table for each area displaying data for air pressure (hp), air pressure trend, air temperature (°C), wind speed (kn), visibility (km), and cloud cover (?/8) over three consecutive days.
- Have students make observations about data. Note that units are not the same, so no real comparison can be made.
- Make necessary conversions. (Optional: Encourage students to derive their own formula to convert Fahrenheit degrees to Celsius given that the freezing point of H₂O is 0 degrees C and 32 degrees F, boiling point of H₂O is 100 degrees C and 212 degrees F.)
 - temperature: $C = 9/5 F - 32$
 - air pressure: 1 in Hg = 33.86 millibars = 33.86 hp (hecto pascals)
 - wind speed: 1 knot = 1.85 km
1 mile = 1.6 km
- Create a graph comparing temperatures and wind speeds for the two regions over three days (have students discuss and select best way to display data)
- Select a descriptor from the Weather Categories and Descriptors Chart (R-2) that best matches the your weather data from each location, and put them in the Descriptor Table for Local and Antarctic Weather (W-2) (use the Beaufort Windscale (R-3) and Windchill Index Chart (R-4) to help you choose the best wind speed and temperature descriptors). Select the descriptor that fits the data for the other categories, keeping in mind the trends in weather so that you can make predictions for the next day's forecast (note that air pressure trends are described as rising, steady, or falling).

Performance Assessment:

Students will make predictions of forecast for the following day using Predicted Descriptors/Actual Descriptors (W-3).

Suggested Rubric:

3 Points: The student will support his/her choice of predicted descriptors by citing specific examples of data and trends from the previous three days. The conclusion will compare and contrast the actual descriptors with those that were predicted for each category. These comparisons will be specifically cited to explain how future predictions might be improved.

2 Points: The student will support his/her choice of predicted descriptors by describing general trends in the data from the previous days. The conclusions will compare and contrast the actual and predicted descriptors for some of the categories. The student will explain how future predictions might be improved. This explanation will make general references to comparisons.

1 Point: The student will make predictions that have unclear connection to previous data. The conclusion will list the actual and predicted descriptors and the conclusion will explain how future predictions may be improved without making specific references to previous results.

Extension/Follow Up:

- Students may conduct experiments on the angle of light and the resulting temperature on a surface in order to explain the reason for the different seasons in Antarctica and the USA.
- Students may study patterns in elevation on topographical maps to determine pathways for catabatic winds.

- Students may collect data on wind direction, air pressure, and weather patterns over an extended time period to determine if there are clear relationships between these factors.

Authors:

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SAMPLE DATA

July 31, 1998

Scott Base

Air Pressure: 991.1 hp and Falling
 Air Temperature: -33.0°C
 Wind direction: N/A°, speed: Kts
 Visibility: 50km
 Cloud: 0/8
 Remarks:

BWI

28.66 in and Steady
 78° F
 Southeast at 10 mph
 6 mi
 1/8

July 30, 1998

Scott Base

Air Pressure: 1002.9 hp and Falling
 Air Temperature: -30.9°C
 Wind direction: 030°, speed: 23 Kts
 Visibility: 10km
 Cloud: 6/8
 Remarks: Wind chill approx -60degC, kinda chilly!

BWI

29.88 in and Falling
 81° F
 East 8 mph
 6 mi
 3/8
 Less humid

July 29, 1998

Scott Base

Air Pressure: 1003.3 hp and Steady
 Air Temperature: -31.8°C
 Wind direction: 030°, speed: 9 Kts
 Visibility: 20km
 Cloud: 3/8
 Remarks:

BWI

35.23 in and Falling
 85° F
 North, 10 - 15 mph
 2 mi
 6/8
 Chance of showers

July 28, 1998

Scott Base

Air Pressure: 1001.4 hp and Steady
 Air Temperature: -24.4°C
 Wind direction: 320°, speed: 17 Kts
 Visibility: 30km
 Cloud: 3/8
 Remarks:

BWI

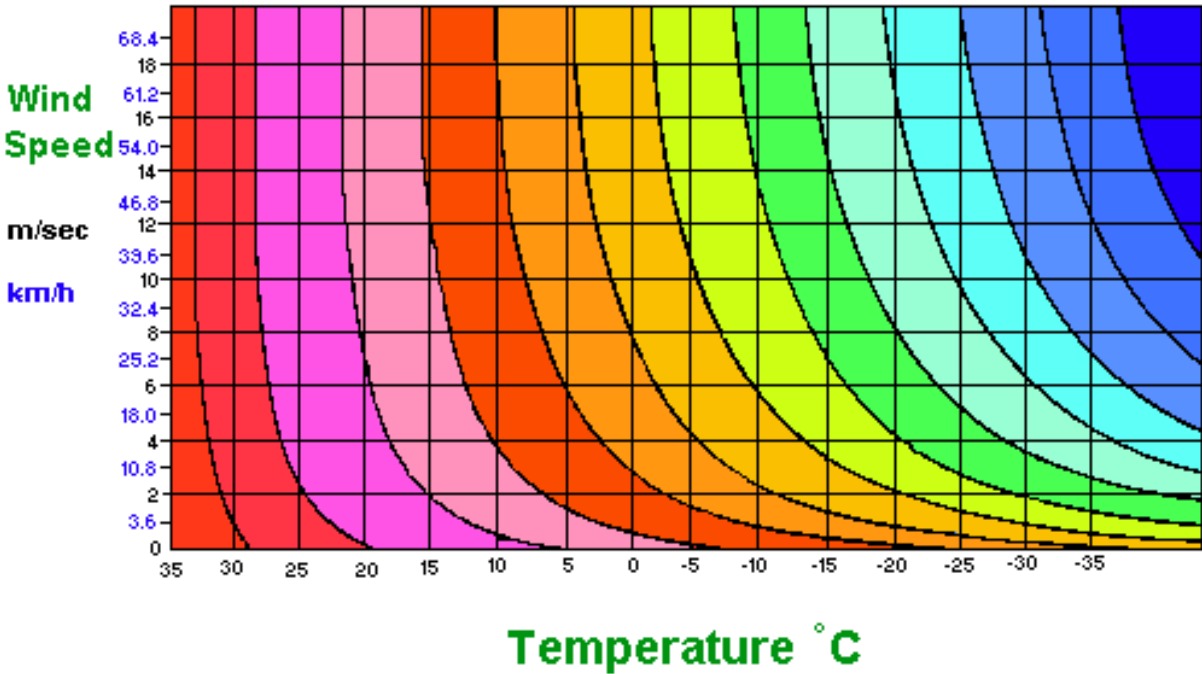
33.23 in and Rising
 95° F
 North, 10 mph
 1 mi
 7/8
 Shwrs & thunderstrms

Weather Categories and Descriptors Chart

Temperature	Cloud Cover	Visibility	Wind speed	Forecast
hot	partly cloudy	very good	calm	improving
warm	cloudy	good	light air	same
pleasant	overcast	limited	light breeze	deteriorating
cool	heavy overcast	poor	gentle breeze	
very cool		very poor	moderate breeze	
cold		zero	strong breeze	
very cold			moderate gale	
bitterly cold			fresh gale	
exposed flesh freezes			whole gale	
			storm	
			hurricane	

BEAUFORT SCALE	WIND SPEED		SAILOR'S DESCRIPTION	WEATHER MAP SYMBOL
	km/hr	mph		
0	below 1	below 1	Calm	
1	1-5	1-3	Light air	
2	6-11	4-7	Light breeze	
3	12-19	8-12	Gentle breeze	
4	20-28	13-18	Moderate breeze	
5	29-38	19-24	Fresh breeze	
6	39-49	25-31	Strong breeze	
7	50-61	32-38	Moderate gale	
8	62-74	39-46	Fresh gale	
9	75-88	47-54	Strong gale	
10	89-102	55-63	Whole gale	
11	103-117	64-75	Storm	
12	above 117	above 75	Hurricane	

Windchill Index Chart



- | | | |
|----------|-----------|-----------------------|
| Hot | Cool | Very Cold |
| Warm | Very Cool | Bitterly Cold |
| Pleasant | Cold | Exposed Flesh Freezes |

REAL DATA

DAY 4

	Scott Base	Local
Air Pressure:		
Air Temperature:		
Wind direction:		
Visibility:		
Cloud:		
Remarks:		

DAY 3

	Scott Base	Local
Air Pressure:		
Air Temperature:		
Wind direction:		
Visibility:		
Cloud:		
Remarks:		

DAY 2

	Scott Base	Local
Air Pressure:		
Air Temperature:		
Wind direction:		
Visibility:		
Cloud:		
Remarks:		

DAY 1

	Scott Base	Local
Air Pressure:		
Air Temperature:		
Wind direction:		
Visibility:		
Cloud:		
Remarks:		

Descriptor Table For Local and Antarctic Weather

DAY 1

Weather Categories	Local Descriptors	Antarctic Descriptors
Temperature		
Cloud Cover		
Visibility		
Wind speed		
Air Pressure		

DAY 2

Weather Categories	Local Descriptors	Antarctic Descriptors
Temperature		
Cloud Cover		
Visibility		
Wind speed		
Air Pressure		

DAY 3

Weather Categories	Local Descriptors	Antarctic Descriptors
Temperature		
Cloud Cover		
Visibility		
Wind speed		
Air Pressure		

PREDICTED DESCRIPTORS

DAY 4

Weather Categories

Local Descriptors

Antarctic Descriptors

Temperature

Cloud Cover

Visibility

Wind speed

Air Pressure

Now that you have made your prediction, obtain the real weather data for day 4 from your teacher and convert it into actual descriptors.

ACTUAL DESCRIPTORS

Temperature

Cloud Cover

Visibility

Wind speed

Air Pressure

Below, write a conclusion summarizing the accuracy of your prediction and discuss ways that you might improve future forecasts.

Conclusion and Discussion: